Carbon K-edge NEXAFS of Coke Deposited on Catalysts

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Introduction: Coke is ubiquitously deposited on catalysts involved in the transformation of hydrocarbons. Characterizing the nature of the coke is a first step in developing methods to suppress coke formation. While there are many methods for characterizing the coke once it has been extracted from the catalyst there are only a few that can be used on the coked catalyst itself e.g. nmr, Raman. There have only been a few reports of the applicability of C NEXAFS to study coked catalysts. This work aims to understand both the spectroscopy and the coking mechanism.

Methods and Materials: Data were collected at the carbon K-edge using both electron and fluorescence yield detection on several powdered catalysts.

Results: Fig. 1 shows the C K-edge NEXAFS data from three different coked catalysts. Clearly the form of the coke is dramatically different on the three materials: especially the relative ratio of the π^* and σ^* peaks indicative of the amount of graphitic and aliphatic coke. Moreover, we were able to detect differences in the electron yield and fluorescence yield signals from several samples indicating differences in the coke near the surface from that in the bulk.

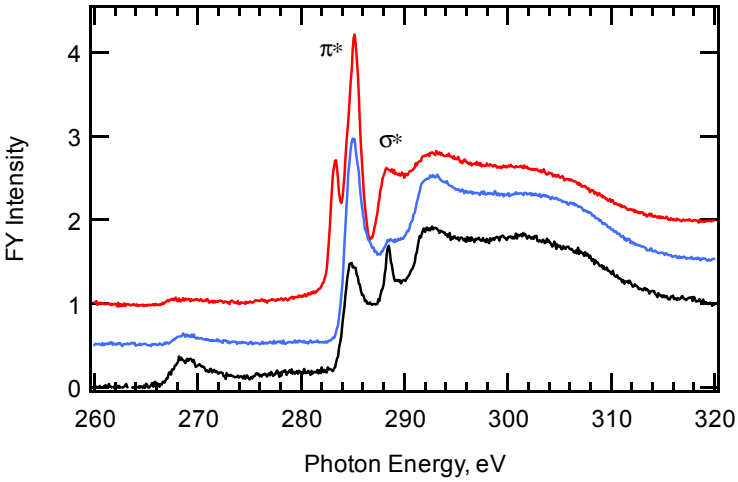

Figure 1. C K-edge NEXAFS of several different coked catalysts.

Conclusions: C K-edge EXAFS could be a powerful method to characterize coke on catalysts. However, scattered light present problems when collecting data in fluorescence, unless a large amount of carbon is present on the sample.

References: S.M Davis et al., J. Catalysis **139**, 322 (1992); H. Shimada et al., J. Phys. IV France C2 **7**, 919 (1997).